

**Title V CAM Equivalent Monitoring**  
**Intermountain Generating Station**  
**Main Boiler Carbon Monoxide Emissions**

**I. Background**

**A. Emissions Unit**

Description:	Steam Generators, coal-fired
Identification:	1SGA, 2SGA
Facility:	Intermountain Generating Station Delta, Utah

**B. Applicable Regulation, Emission Limit, and Monitoring Requirements**

Regulation:	40 CFR Part 51
Permit:	AO replacing DAQE-049-02 Title V Operating Permit #2700010002
Emission limits:	
Carbon Monoxide:	1320 lb/hr
Monitoring requirements:	Parametric Boiler Data: Percent O2, OFA Status

**C. Control Technology**

Good combustion practice (GCP). For purposes of this CAM, GCP means combustion with minimum percent O2 in the boiler exit flue gas so that CO does not exceed 250 ppm. The O2 values vary with over fire air (OFA) operating conditions.

**II. Monitoring Approach**

The key elements of the monitoring approach are presented in the following table:

**TABLE CAM MONITORING APPROACH**

<b>Intermountain Generating Station</b>		<b>OFA Service Condition</b>
I. Indicator	<b>Main Boiler Carbon Monoxide Emissions</b>	
Measurement Approach	Combustion flue gas percent O <sub>2</sub> will be monitored at the exit path of each boiler. CO concentration will then be calculated utilizing O <sub>2</sub> values. Conversion from ppm to lb/mmBtu shall be made by incorporating design heat input.	OFA operating condition shall be monitored. Monitoring shall include OFA position and status: i.e., No OFA, 1/3 OFA, 2/3 OFA, full port OFA, throttled or open. OFA status shall determine curve by which CO concentration shall be calculated.
II. Indicator Range	An excursion is defined as an exceedence of GCP, except for start-up, shutdown, planned / maintenance outages, or malfunction. CO concentration will be determined in ppm by calculation of percent O <sub>2</sub> against developed curves (attached) for various over fire air operating conditions. Good combustion practice include operating conditions whereby CO concentration does not exceed 250 ppm in the flue gas.	An excursion is defined as an exceedence of the permit limit, except for start-up, shutdown, planned/maintenance outages, or malfunction. CO concentration will be determined in ppm by calculation of percent O <sub>2</sub> against developed curves (attached) for various over fire air operating conditions. Good combustion practice include operating conditions whereby CO concentration does not exceed 250 ppm in the flue gas.
III. Performance Criteria		
A. Data Representativeness <sup>b</sup>	Measurements are weighted average results collected from several sensors located in each boiler exit flue path 4 times per hour.	Operational status is measured by OFA system damper position.
B. Verification of Operational Status	NA	Operational status shall be recorded in the Plant Information system.
C. QA/QC Practices and Criteria	Calibrations shall be maintained within manufacturers recommendations.	OFA system falls under an PM program.
D. Monitoring Frequency	Continuous, compiled weekly.	Instantaneous, compiled weekly.
Data Collection Procedure	Measurements are recorded in PI.	Status is recorded in PI.
Averaging Period	30-day rolling average.	30-day rolling average.

**JUSTIFICATION****I. Background**

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The pollutant-specific emission units are the main boiler steam generators 1SGA and 2SGA. Fossil fuel combustion can generate carbon monoxide (CO). Control of CO is accomplished through utilization of Good Combustion Practice (GCP) which balances boiler performance against environmental parameters, such as nitrogen oxides (NOx) and CO. Testing was performed to determine the relationship between boiler operating parameters and CO emissions. The test curves are attached in support for the following rationales.

**II. Rationale for Selection of Performance Indicators**

Percent O2 in the boiler exit flue gas was selected as the performance indicator because it is indicative of GCP ranges developed through testing. Testing curves show a direct correlation between percent O2 and carbon monoxide for various operating conditions. When GCP is utilized, CO emissions can be minimized when NOx is also minimized. Decreases in percent O2 correlate to increases in CO, and CO can be calculated based upon percent O2, and then directly compared to permit limits.

**III. Rationale for Selection of Indicator Ranges**

The selected indicator range for good combustion practice is based upon operating conditions. Those conditions and percent O2 associated with 250 ppm CO are tabled below:

<b><u>OFA Operating Status</u></b>	<b><u>Percent O2 = 250 ppm CO</u></b>
No OFA	2.0%
1/3 OFA	2.0%
2/3 OFA - throttled	2.0%
2/3 OFA - full open	1.75%

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An excursion occurs when 250 ppm CO is exceeded, except for startup, shutdown, planned / maintenance outage, or malfunction. When an excursion occurs, boiler operation will be evaluated to determine the reason of the occurrence and to decide the action required to correct the situation. The evaluation will include a complete re-calculation conversion to lb/mmbtu to determine actual compliance with the permit limit.

All excursions will be documented, and if a conversion is made that indicates an emission of greater than 1320 lb/ based upon a 30 day rolling average, the excursion will be reported. An indicator range of percent O<sub>2</sub> relating to 250 ppm CO was selected because: (1) an increase in CO emissions is indicative of a change in good combustion practice; and (2) a monitoring technique which does not require a new CEM installation is desired. Although percent O<sub>2</sub> is an indirect measurement for CO, the correlation being used has been tested to provide good determination of CO using percent O<sub>2</sub>.

#### IV. Methodology for Determination of CO

The formula for calculating CO in ppm follows the general equation:

$$[C_{ppm}] = n * (O_2\%)^a,$$

where;  $[C_{ppm}]$  = concentration of CO in parts per million;  
 n = curve specific factor;  
 O<sub>2</sub>% = percent O<sub>2</sub> measured at boiler exit;  
 a = curve specific exponent.

The following table identifies n and a for each OFA operating condition:

<b><u>OFA Operating Condition</u></b>	<b><u>n</u></b>	<b><u>a</u></b>
No OFA	47259	-7.6817
1/3 OFA	66265	-7.9824
2/3 OFA - throttled	4029.2	-4.0112
2/3 OFA - full open	1372.4	-3.0919

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The emission limit is verified by the conversion to pounds per hour, calculated as:

$$[C_{lb/hr}] = [C_{ppm}] * 2.59 * 10^{-9} * MW * F_d * 20.9 / (20.9 - O_2\%) * H_I$$

where;  $[C_{lb/hr}]$  = pound per hour emission rate  
 $[C_{ppm}]$  = CO concentration in parts per million  
 $2.59 * 10^{-9}$  = conversion factor for pound per standard cubic feet  
MW = molecular weight of CO  
 $F_d = \square F \square$  factor to convert standard cubic feet per million BTU heat input.  
 $O_2\%$  = excess combustion oxygen, in percent  
 $H_I$  - heat input, in million BTU per hour